Clinical History: A 65-year-old non-smoking man with a past medical history significant only for dyslipidemia and hypertension presented to the emergency room with a 2-week complaint of intermittent, diffuse, high back pain accompanied by sweating and nausea and non-bloody emesis. The back pain does not radiate. The patient also notes that recently he has suffered from pronounced fatigue and some shortness of breath; until recently he had been an endurance athlete.

Physical Examination: Physical examination was normal; in particular, the back pain was not reproducible on palpation. The patient was afebrile.

Laboratory: Laboratory data were remarkable for a mildly elevated white blood cell count of $11 \times 10^9$ cells/L. Serum chemistries were within normal limits and cardiac troponins were negative. Oxygen saturation on room air was 94%.

Radiography: Frontal and lateral chest radiography (Figure 1) was performed.

Which of the following statements regarding the chest radiograph is most accurate?

1. The frontal chest radiograph shows a large left pleural effusion
2. The frontal chest radiograph shows an abnormally widened mediastinum
3. The frontal chest radiograph shows multifocal consolidation
4. The frontal chest radiograph shows no significant findings
5. The frontal chest radiograph shows numerous small lung nodules
The frontal chest radiograph shows no significant findings. The chest radiograph shows elevation of the left diaphragm with associated left basilar atelectasis. While not a normal finding, it is unlikely this abnormality is responsible for the patient’s presenting complaints. No lung nodules are present, nor is multifocal consolidation [some mild opacity at the left base- likely related to atelectasis due to the elevated left diaphragm- is present]. The mediastinal contours are within normal limits. No pleural effusion is seen.

The emergency room physician was suspicious for thoracic aortic dissection, given the past medical history of hypertension in combination with upper back pain.

Which of the following is the most appropriate next step for the evaluation of this patient?

1. $^{99m}$Tc-MAA ventilation – perfusion scan
2. Contrast – enhanced thoracic CT
3. Repeat chest radiography
4. Thoracic MRI with contrast – enhanced MR angiography
5. Unenhanced and enhanced thoracic CT angiogram (CTA)
The combination of initial unenhanced CT followed by enhanced CT angiography is the proper “aortic dissection” protocol. While enhanced CT alone is a reasonable test for suspected aortic pathology, the unenhanced portion of the “CT aorta” protocol optimizes detection of aortic intramural hematomas and assists in distinguishing eccentric atherosclerotic plaque within the aorta from both intramural hematomas and the thrombosed false lumen of a dissection. Both intramural hematomas and thrombosed false lumens in dissection patients can be recognized at enhanced CT, but, owing to the presence of intraluminal intravenous contrast, these pathologies will appear as low attenuation foci and may therefore resemble low attenuation atherosclerotic plaque. On unenhanced imaging, however, the acute blood products of intramural hematoma and acutely thrombosed dissection false lumens will show hyperattenuation, whereas atherosclerotic plaque will appear as low attenuation. Thoracic MRI with contrast-enhanced MRA is an excellent test for suspected aortic pathology and is the test of choice when thoracic CTA cannot be performed, such as for patients with iodinated contrast allergies. However, thoracic CTA remains the first-line examination for suspected acute aortic syndromes owing to its widespread availability and speed, as well as the fact CT is well-tolerated (i.e., no claustrophobia). Repeat chest radiography is unlikely to be of benefit. $^{99m}$Tc-MAA scintigraphy is primarily used for suspected pulmonary embolism, but pulmonary embolism is not the primary consideration for this patient’s presentation.

The patient underwent unenhanced and enhanced thoracic CTA (Figure 2).
Figure 2. A-I: Unenhanced and enhanced thoracic CTA (unenhanced phase not displayed). J-L: Sagittal enhanced thoracic CTA.

Which of the following is correct regarding the description of the thoracic CT findings?

1. Thoracic CTA shows a large pericardial effusion
2. Thoracic CTA shows a superior-posterior mediastinal mass
3. Thoracic CTA shows acute pulmonary embolism
4. Thoracic CTA shows an acute aortic dissection
5. Thoracic CTA shows extensive pleural abnormality
Correct!

2. Thoracic CTA shows a superior-posterior mediastinal mass

Unenhanced and enhanced thoracic CTA shows a normal appearing ascending and descending thoracic aorta; no evidence of acute aortic syndrome is present. No evidence of pulmonary embolism or pericardial abnormality is present. A soft tissue mass in the superior posterior mediastinum (Figure 3, arrows) is present, just anterior to the cranial thoracic spine.

Figure 3. A-I: Enhanced thoracic CTA shows a normal appearing ascending (a) and descending (*) thoracic aorta; no evidence of acute aortic syndrome is present. A soft tissue mass in the superior posterior mediastinum (arrows) is present, just anterior to the cranial thoracic spine. J-L: Sagittal enhanced thoracic CTA shows a normal-appearing ascending (a) and descending (*) thoracic aorta. A soft tissue mass in the superior posterior mediastinum (arrows) is present, just anterior to the cranial thoracic spine.
This abnormality is not readily apparent, even in retrospect, on the chest radiograph (Figure 1).

Based on the CT appearance, which of the following should **NOT** be included in the differential diagnosis for the finding at thoracic CT?

1. Esophageal neoplasm
2. Intrathoracic goiter
3. Lymphoma
4. Mediastinal abscess
5. Neurogenic tumor
Correct!

2. Intrathoracic goiter

Among the choices listed, intrathoracic goiter is least likely to be responsible for the findings at the thoracic CT because the mediastinal lesion is clearly spatially separated from the normal thyroid gland, seen superiorly and anteriorly from the mass. Intrathoracic goiter extension is almost always closely associated with, and is usually seen in contact with, the normal thyroid gland in the inferior neck. Very rarely, ectopic thyroid tissue could account for a thyroid goiter that does not contact the normal thyroid gland, but such occurrences are exceedingly rare and, when present, are often anteriorly located. A mediastinal abscess, due to esophageal pathology or adjacent osteomyelitis, may present in this fashion. Non-Hodgkin lymphoma is more typically associated with multi-compartmental lymph node enlargement, rather than an isolated superior – posterior mediastinal soft tissue mass, whereas Hodgkin lymphoma more commonly presents as an anterior mediastinal mass. However, atypical presentations of common disorders, such as non-Hodgkin lymphoma, suggest that the unusual presentation of non-Hodgkin lymphoma as a superior posterior mediastinal mass may occasionally occur. Given the proximity of the soft tissue mass to the posterior portion of the esophagus, a neoplasm arising from the esophagus is a leading consideration. Finally, while more commonly off-midline in a paraspinous position, a neurogenic neoplasm could present in this manner.

Which of the following would be most useful to determine the etiology of the superior posterior soft tissue mediastinal mass?

1. Cervical mediastinoscopy
2. Chamberlain procedure
3. Endoscopic ultrasound with needle biopsy
4. Percutaneous transthoracic needle biopsy
5. Video – assisted thoracoscopic surgery
3. Endoscopic ultrasound with needle biopsy

Endoscopic ultrasound with needle biopsy is the most useful procedure for the evaluation of the posterior superior mediastinal mass among those listed. Given the proximity of the mass to the posterior wall of the esophagus, the lesion should be readily visible and accessible by endoscopic ultrasound. The lesion is not readily accessible with percutaneous transthoracic needle biopsy given its location near the narrow thoracic inlet (the inlet’s osseous structures effectively surround the access routes to the mass) as well as the proximity of the great vessels in this region. The Chamberlain procedure, or left anterior mediastinotomy, is a surgical approach through a left superior intercostal space used to access the left anterior mediastinum and subaortic space, typically in the context of lung cancer staging; the superior posterior mediastinal mass in this patient is not accessible with this procedure. Similarly, cervical mediastinoscopy is commonly used in the setting of lung cancer staging and accesses the paratracheal and anterior subcarinal spaces, but the mass in this patient is too posteriorly located to be sampled with cervical mediastinoscopy. Finally, given that the mass bulges the pleura bilateral, video-assisted thoracoscopic surgery (VATS) sampling may be feasible, but the access to the mass is limited and a VATS approach would be difficult, and certainly not preferable to an endoscopic approach.

The patient underwent endoscopic ultrasound with needle biopsy of the superior posterior mediastinal lesion (Figure 4).

![Figure 4. Endoscopic ultrasound with needle biopsy shows a heterogeneous, predominantly hypoechoic mass (arrow) just posterior to the esophagus. Needle placement into the lesion is shown (arrowheads).]
The esophageal mucosa appeared normal, and the mass seen at CT was noted to be inseparable from the posterior wall of the esophagus. The mass was non-vascular at color Doppler ultrasound. No regional lymph node enlargement was seen. Biopsy was performed and material sent for cytology and culture.

Which of the following represents the **next most appropriate step** for the evaluation of this patient?

1. $^{18}$FDG – PET scanning  
2. Contrast esophagram  
3. Contrast-enhanced thoracic MRI  
4. High – resolution thoracic CT  
5. Unenhanced thoracic CT
3. Contrast-enhanced thoracic MRI

Unenhanced thoracic CT is unlikely to show findings not already known by previous enhanced thoracic CT and endoscopic ultrasound. A contrast esophagram is a reasonable test to consider, particularly given Zenker’s diverticulum is a consideration, but is unlikely to add information to that already provided by endoscopic ultrasound. The likelihood of Zenker’s diverticulum is low, given the heterogeneous CT appearance, with no gas within the lesion, and the lack of connection to the esophageal lumen at endoscopic ultrasound. High-resolution thoracic CT is primarily performed for the assessment of diffuse lung disorders or bronchiectasis, and would add no additional information in this patient beyond that already known with unenhanced thoracic CT. 

$^{18}$FDG-PET scanning may be capable of showing increased glucose utilization in the superior posterior mediastinal mass, but metabolic activity within the lesion would not distinguish between inflammatory and neoplastic etiologies. Furthermore, the lack of increased tracer utilization within the mediastinal lesion would not mitigate the need for further evaluation. Contrast-enhanced MRI has the ability to further characterize the mediastinal lesion and, in particular, assess for a potential spinal etiology and effects on the spinal canal. Furthermore, contrast-enhanced thoracic MRI may show imaging characteristics that may be specifically suggestive of neurogenic tumor.

The patient underwent CT of the abdomen and pelvis, which was unremarkable. Contrast-enhanced thoracic MRI (Figure 5) was performed.

Figure 5. A-H: Axial contrast-enhanced T1-weighted (A-C), axial T2-weighted (D-F) and sagittal T2-weighted (G and H) MR imaging of the thoracic spine
Which of the following is **correct** regarding the description of the thoracic MRI findings?

1. The thoracic MR shows extensive inflammation centered on the intervertebral disc space in the upper thoracic spine
2. The thoracic MR shows features characteristic of a neurogenic tumor
3. The thoracic MR shows hypointense signal on T2-weighted imaging, suggesting a fibrous or cellular lesion
4. The thoracic MR shows that a non-enhancing cystic lesion accounts for the superior posterior mediastinal mass
5. The thoracic MR shows that the superior posterior mediastinal lesion contains gas and fluid levels
1. The thoracic MR shows extensive inflammation centered on the intervertebral disc space in the upper thoracic spine

The contrast – enhanced thoracic MRI shows that the superior posterior mediastinal soft tissue enhances extensively, which is indicative of a solid lesion and effectively excludes a completely cystic lesion (Figure 6).

No gas-fluid level is seen within the lesion. The soft tissue shows hyperintense, not hypointense, signal on T2-weighted imaging; the hyperintense signal is non-specific, but is consistent with edema and inflammation. There is no evidence that the mediastinal soft tissue is either hypercellular or fibrous in nature. The imaging characteristics are not suggestive of neurogenic tumor; the lesion is midline and poorly circumscribed, whereas neurogenic tumors tend to be circumscribed and positioned in a paraspinal location. The MRI does show extensive vertebral body signal abnormality centered on the intervertebral disc space.

Figure 6. MR imaging of the thoracic spine shows the superior posterior mediastinal soft tissue enhances extensively, which is indicative of a solid tissue and effectively excludes a completely cystic lesion. The hyperintense T2-weighted signal is non-specific, but is consistent with edema and inflammation. Extensive vertebral body signal abnormality centered on the intervertebral disc space (arrowheads, G and H) is particularly evident on the sagittal T2-weighted images.
The biopsy material obtained at endoscopic ultrasound sent for Gram stain showed many white blood cells and few Gram-positive cocci. Coccidioidomycosis and histoplasmosis testing were negative. Blood cultures performed near the time of admission grew methicillin-sensitive *Staphylococcus aureus*, but this was felt to be a contaminant. Subsequently, biopsy material obtained at endoscopic ultrasound grew *Staphylococcus intermedius*; the patient was noted to have a dog, and this organism is known to be a part of the normal canine flora. Antibiotic therapy with Ceftriaxone was begun and both cardiovascular and neurosurgery were consulted, with the plan to repeat the contrast-enhanced thoracic MRI in several weeks to assess for interval change, with the possibility of surgical decompression reserved for evidence of progression at repeat imaging.

Diagnosis: Posterior mediastinal abscess due to discitis with vertebral body osteomyelitis

**References**